TITLE OF THE INVENTION

INFORMATION PROCESSING APPARATUS, AND METHOD OF
ASSIGNING FUNCTION TO KEY

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the
benefit of priority from the prior Japanese Patent
Application No. 2002-338059, filed November 21, 2002,
the entire contents of which are incorporated herein by
reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an information
processing apparatus comprising keys to which functions
can be assigned, and a method of assigning a function
to a key.

2. Description of the Related Art

Information processing apparatuses such as
personal computers are provided with various keys
operated by a user, such as hardware keys and operation
buttons provided on an operation section and software
keys provided on a display screen. As means for
assigning particular functions to predetermined ones of
these keys, a method of selecting beforehand functions
from a list of functions to keys to which functions are
assigned has hitherto been applied (refer to, for
example, a manual for "ATOK13", Justsystem Corporation,
first version issued on September 8, 1999 [p.74 "Key

Customize"]).

However, with such a conventional method of
assigning a function to a key, the functions that can
be assigned to the keys are limited to the functions on
5   the previously prepared list. Accordingly, if for
example, the user desires to assign other functions
depending on an application, this cannot be achieved by
the conventional method.

As described above, the conventional method of
10   assigning a function to a key is not versatile because
the functions that can be assigned to the keys are
limited to previously prepared functions.

BRIEF SUMMARY OF THE INVENTION

According to an embodiment of the present
15   invention, an information processing apparatus
comprises:

a function database which stores functions which
can be assigned to keys, the functions being
categorized according to types of the functions; and
20   an assigning unit which assigns an arbitrary one
of the functions stored in the function database to one
of the keys.

According to an embodiment of the present
invention, a method of assigning a function to a key of
25   an information processing apparatus, the method
comprises:

creating a database for storing functions

categorized according to types of the functions; and

of presenting a user with the stored functions.

Additional objects and advantages of the present

invention will be set forth in the description which

5   follows, and in part will be obvious from the

description, or may be learned by practice of the

present invention.

The objects and advantages of the present

invention may be realized and obtained by means of the

10   instrumentalities and combinations particularly pointed

out hereinafter.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The accompanying drawings, which are incorporated

in and constitute a part of the specification,

15   illustrate embodiments of the present invention and,

together with the general description given above and

the detailed description of the embodiments given

below, serve to explain the principles of the present

invention in which:

20   FIG. 1 is a block diagram showing a main part of

an embodiment of the present invention;

FIG. 2 is a view showing a configuration of

a database according to the embodiment;

FIG. 3 is a view showing a configuration of

25   a table according to the embodiment;

FIG. 4 is a block diagram showing a configuration

of an information processing apparatus according to

the embodiment;

FIG. 5 is a flowchart showing a process procedure of automatically constructing a function database 11;

FIG. 6 is a flowchart showing a process procedure of assigning a function to an operation button (key);

FIG. 7 is a flowchart showing a process procedure of changing and adding the function database 11;

FIG. 8 is a flowchart showing a process procedure of changing the function database 11 by operating particular buttons (keys);

FIG. 9 is a flowchart showing a process procedure of assigning functions;

FIG. 10 is a flowchart showing a process procedure of executing a function by operating a key of the group of keys with reference to the function database 11; and

FIG. 11 shows an example of changes in user interface screen made to allow the user to change the function database 11.

DETAILED DESCRIPTION OF THE INVENTION

An embodiment of an information processing apparatus according to the present invention will now be described with reference to the accompanying drawings. FIG. 1 is a block diagram showing a main part of the embodiment of the present invention.

Functions that can be assigned to keys are described in a function database 11. The function database 11 is automatically constructed by processing

in the system. For example, functions sampled from the
system are classified into a key code group and
a program group so as to constitute respective
databases. In the present embodiment, in addition to

5   these databases, a database for a previously used
function group is provided. Thus, every time a
function is newly assigned to a key, a function
previously assigned to this key is stored in the
database for the previously used function group.

10   A user can arbitrarily assign functions to a group
of keys 12. The group of keys 12 includes, for
example, keys and operation buttons provided on
a keyboard unit, hardware keys and operation buttons
provided on a console panel, and software keys provided

15   on a display screen. For example, functions can be
assigned to activation buttons for particular programs
and a plurality of operation buttons called "general
purpose buttons" or the like, all of which are provided
on the console panel.

20   A user interface 13 presents (displays) a function
list to the user, controls the function database 11,
assigns (sets) functions to the group of keys 12, and
performs other operations. The user interface 13
achieves GUI functions using operation screens for

25   various processes shown in FIGS. 6 to 11, described
later.

           FIG. 2 shows an example of a configuration of the

function database 11, shown in FIG. 1. The function
database 11 comprises a database 21 for the key code
group, a database 22 for the program group, and a
database 23 for the previously used function group 23.

5   The database 21 for the key code group is a group
of databases that store, for the group of keys 12 to
which the functions can be assigned as shown in FIG. 1,
key codes used to provide the same functions as
provided if corresponding keys on the keyboard are
10   pressed.

The database 22 for the program group is a group
of databases that store programs that can be assigned
to the group of keys 12 to which the functions can be
assigned as shown in FIG. 1.

15   The database 23 for the previously used function
group is a group of databases in which functions used
by the user are accumulated. As described above, every
time a function is newly assigned to a key, the
function assigned to this key is stored as a previously
20   used function.

FIG. 3 shows a table referenced in the system when
a key of the group of keys 12 is operated to execute
the corresponding function with reference to the
function database 11. The contents of the table are
25   updated whenever a function is assigned to (defined
for) a key of the group of keys 12 to which functions
can be assigned. In the group of keys 12, the function

of a "word processor" belonging to the program group is assigned to a key K1. The function of "Alt+a" (an operation of a combination of an "Alt" key and an "a" key) belonging to the key code group is assigned to a key K2.

FIG. 4 is a block diagram showing an example of a configuration of an information processing apparatus according to the embodiment. A notebook type personal computer integrated with a display device will be taken by way of example. The computer comprises a computer main body and a display unit (a display section housing). The display unit incorporates a display device 121 using an LCD, as an internal display. The display unit is attached to the computer main body for moved between an open position and a closed position. The computer main body has a housing shaped like a thin box. A top surface of the housing is provided with a keyboard (KB) 200 and a plurality of operation buttons (K1, K2, and K3) 201, 202, and 203 constituting the group of keys 12 to which functions can be assigned as shown in FIG. 1.

The computer main body is provided with a CPU 110, a memory controller hub 120, a memory 130, a graphics controller 140, video RAM (VRAM) 141, an I/O hub 150, a BIOS-ROM 160, a hard disk drive (HDD) 170, a sound controller 180, an embedded controller (EC) 190, the keyboard 200, and other components.

The embedded controller (EC) 190 accepts an operation input through the keyboard (KB) 200 or the operation button (K1, K2, or K3) 201, 202, and 203 to execute a process corresponding to that key (button)

5   operation. When one of the plurality of operation buttons (K1, K2, and K3) 201, 202, and 203 is operated which constitute the group of keys 12 to which functions can be assigned as shown in FIG. 1, the CPU 110 is notified of this button operation.

10   The CPU 110 is provided to control operations of the personal computer, and executes various processes in accordance with an operating system (OS) loaded from the hard disk drive (HDD) 170 into the memory 130, an application program, a utility program, or a BIOS

15   stored in the BIOS-ROM 160, or the like. In this embodiment, under the control of the OS and a program that executes a process of assigning a function to a key, the CPU 110 executes a process of automatically constructing the function database 11 (see FIGS. 5

20   and 6), a process of changing or adding the function database 11 using the user interface screens (see FIGS. 7 and 8), and a process of assigning a function to an operation button (key) using the user interface screens (see FIG. 9). Furthermore, upon receiving

25   a notification of operation of one of the operation buttons (K1, K2, and K3) 201, 202, and 203 from the embedded controller (EC) 190, the CPU 110 executes

a process corresponding to the function assigned to this operation button (key) with reference to the table shown in FIG. 3, under the control of the OS (see FIG. 10).

Under the control of the OS executed by the CPU 110, the graphics controller 140 drives the display of the internal display (LCD) 121 and the display of external displays connected to a DVI terminal 142, a CRT terminal 143, and others. In this case, the graphics controller 140 displays the contents of the automatically constructed function database, displays the user interface screens used to assign a function to an operation button (key), displays the user interface screens used to change and add the function database 11, and performs other operations.

The hard disk drive (HDD) 170, used as external storage, retains the automatically constructed function database 11, the table shown in FIG. 3, and the like. In the VRAM 141, display images of the various user interface screens (see FIG. 11) displays on the internal display (LCD) 121 are expanded.

FIGS. 5 to 10 are flowcharts showing process procedures according to the embodiment. FIG. 5 is a flowchart showing a process procedure of automatically constructing the function database 11. FIG. 6 is a flowchart showing a process procedure of assigning a function to an operation button (key). FIG. 7 is

a flowchart showing a process procedure of changing and adding the function database 11. FIG. 8 is a flowchart showing a process procedure of changing the function database 11 by operating particular buttons (keys).

5   FIG. 9 is a flowchart showing a process procedure of assigning functions. FIG. 10 is a flowchart showing a process procedure of executing a function by operating a key of the group of keys 12 (operation buttons 201 to 203) with reference to the function

10 database 11.

FIG. 11 shows an example of changes in user interface screen made to allow the user to change the function database 11, to execute an editing process such as addition, and to assign a function to a key

15 (UI-1→UI-2→UI-4→UI-41, UI-1→UI-2→UI-5) and an example of changes in user interface screen made to allow the user to operate a key of the group of keys 12 to execute the corresponding function with reference to the function database 11 (UI-2→UI-3→UI-31). In this

20 figure, reference character UI-1 denotes a user interface screen that allows the user to select an arbitrary one (key) of the plurality of operation buttons (K1, K2, and K3) 201, 202, and 203, constituting the group of keys 12 to which functions

25 can be assigned. Reference character UI-2 denotes a user interface screen that allows the user to select a function assigned to a specified (selected) key.

The user interface screen UI-2 allows the user to
select a preset function (in the figure, a "word
processor" or a "table calculation") that can be
assigned to a key, as well as a function (Select your
5   Program or Select your Key code) arbitrarily assigned
by the user and a previously used function. Program
functions (Select your Program) that can be arbitrarily
assigned by the user include various application
programs (for example, see the user interface screen
10   UI-3 ["table calculation A" and "game A"]) as well as
arbitrary files (for example, see user interface screen
UI-3 ["word processor 2"]→user interface screen UI-31).

        With reference to the drawings, description will
be given of operations of the embodiment of the present
15   invention. In this case, the plurality of operation
buttons (K1, K2, and K3) 201, 202, and 203,
constituting the group of keys 12 to which functions
can be assigned, will be simply referred to as the
"keys".

20   Under the control of the OS and the program that
executes a process of assigning a function to a key,
the CPU 110 executes a process of automatically
constructing the function database 11 as shown in
FIGS. 5 and 6, a process of changing or adding the
25   function database 11 using the user interface screens
as shown in FIGS. 7 and 8, a process of assigning a
function to a key using the user interface screen as

shown in FIG. 9, and other processes. Furthermore,
upon receiving a notification of operation of one of
the operation buttons (K1, K2, and K3) 201, 202, and
203 from the embedded controller (EC) 190, the CPU 110

5   executes the function associated with depression of the
key to which this function is assigned as shown in
FIGS. 10 and 11.

(1) Automatic Construction of Function Database

The function database 11 is automatically

10   constructed by the process shown in FIGS. 5 and 6.

When the system is started, the function database
11 having the database 21 for the key code group and
the database 22 for the program group as shown in
FIG. 2 is automatically constructed by sampling

15   functions (programs and key codes) that can be assigned
to the keys, from various programs and key codes used
in the system and grouping and saving these functions
(steps S101 to S103 in FIG. 5).

Furthermore, after the system has been started,

20   every time the user assigns a function to a key, the
assigned function is saved as a previously used
function to construct the database 23 for the
previously used function group in the function database
11 (steps S201 and S202 in FIG. 6).

25   The function database 11, comprising the database
21 for the key code group, the database 22 for the
program group, and the database 23 for the previously

used function group, is generated in the memory 130 as
main storage and saved in the HDD 170 as external
storage for the processes described later.

(2) Change and Addition to Function Database

5   On the function database 11 automatically
constructed as described above, the user can use a
predetermined user interface to specify a function
group and change a function in the function database 11
or add a function to it. When on a predetermined user

10   interface screen (for example, see the user interface
screen UI-2, UI-4, or UI-41, shown in FIG. 11), the
user specifies a function group and requests and
instructs a change or addition of a function, a process
of changing (steps S301, S302, and S320 in FIG. 7) or

15   adding (steps S311, S312, and S320 in FIG. 7) the
function is executed on the specified one of the
function groups 21, 22, and 23 constituting the
function database 11.

(3) Process of Changing Function Database by Operating

20   Particular Key

By pressing, for a predetermined time, a key the
function of which is to be changed (long depression of
a key) (step S401 in FIG. 8) or simultaneously pressing
the key the function of which is to be changed and a

25   preset particular key (depression of a combination of
keys) (step S402 in FIG. 8), a user interface screen
for function change is displayed to enable the

assignment of the function to the key to be changed on
this user interface screen (for example, see the user
interface screen UI-2, UI-4, or UI-41, shown in
FIG. 11) (steps S403 and S404 in FIG. 8). In this
5   case, every time the user assigns a function to a key,
the assigned function is saved in the database 23 for
the previously used function group in the function
database 11 as a previously used function (step S405 in
FIG. 8). Further, the changed function is reflected in
10   the key (step S406 in FIG. 8).

(4) Process of Assigning Function to Key

When assigning a function to a key, the user
selects the key to which the function is to be assigned
and the function assigned to the key on a user
15   interface screen for a list of keys and functions (for
example, see the user interface screen UI-1 or UI-2,
shown in FIG. 11) (steps S501 to S505 in FIG. 9). In
this case, when one of the function groups (key code
(Select your Key code)/program (Select your
20   Program)/previously used function) is selected on the
user interface screen for a list of functions, a list
of functions in the selected function group is
displayed (for example, see the user interface screen
UI-3 or UI-4, shown in FIG. 11) (step S503 in FIG. 9).
25   When no functions groups are selected, all the
functions registered in the function database 11 are
displayed in list form so as to be freely scrolled

(step S504 in FIG. 9). When a function to be assigned
is selected on the function list screen (step S505 in
FIG. 9), the function selected on the function list
screen is reflected in the selected target key
5   (step S506 in FIG. 9).
(5) Process Executed upon Pressing key to which
Function has Been Assigned
      The key to which the function has been assigned
becomes an operation button that directly starts the
10   system (OS). That is, if the operation of the system
has been stopped (for example, the system has been shut
down or its operation has been suspended) and the OS
has not been started (step S601 NO in FIG. 10), when
the user presses the key to which the function has been
15   assigned, the OS is started (step S602 in FIG. 10) to
start up the system. When the OS has been started
(step S601 YES in FIG. 10), it is determined which key
is pressed (step S603 in FIG. 10). Then, with
reference to the table shown in FIG. 3, the function
20   assigned to the operated key is executed (step S604 in
FIG. 6). For example, when the user selects "Select
your Program" on the user interface screen U1-2, shown
in FIG. 11, and on the user interface screen UI-3,
associated with this selection, selects the user
25   created file "word processor 2", the "word processor 2"
file (user interface screen UI-31) is opened to enable
file operations.

The above function of assigning a function to
a key provides a database having a list displayed as
functions assigned to the keys, and allows the user to
add data to the database or change the database.
Furthermore, the functions are grouped, so that each
function can be easily assigned to one of the keys.

The automatic construction of the function
database saves the user's operation of searching for
a function to be assigned. The presentation of the
grouped functions enables the user to select easily
a function to be assigned.

Further, the automatic construction of the
function database allows the user to search easily for
a function to be assigned and enables the functions to
be presented to groups. This provides a versatile
mechanism that dynamically assigns a function to a key.

Furthermore, if a new function is assigned to
a key, a function previously used for this key is
presented. This allows the user to change easily the
assignment of functions frequently used. Further,
using user interface means for displaying only means
for setting a key to be changed without presenting
means for setting changes in the whole group of keys,
and visually presenting the position of the key in the
apparatus, the user can easily check the key to be
changed.

With the process of automatically constructing

the key code group and the program group in the
function database 11, the group can be reconstructed in
accordance with a predetermined change of event
(for example, a change or update of a program function
not involving restarting the system) or at preset time
intervals. Further, in a system or the like to which
the present invention is applied, it is possible to
change as required the configuration of the function
database 11 shown in FIG. 2, the configuration of the
table shown in FIG. 3, the configuration of the
apparatus (system) shown in FIG. 4, and other
configurations.

As described above, the present invention provides
an information processing apparatus comprising a
versatile mechanism that assigns a function to a key.

While the description above refers to particular
embodiments of the present invention, it will be
understood that many modifications may be made without
departing from the spirit thereof. The accompanying
claims are intended to cover such modifications as
would fall within the true scope and spirit of the
present invention. The presently disclosed embodiments
are therefore to be considered in all respects as
illustrative and not restrictive, the scope of the
invention being indicated by the appended claims,
rather than the foregoing description, and all changes
that come within the meaning and range of equivalency

of the claims are therefore intended to be embraced therein.